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# USSR Report

MILITARY AFFAIRS

No. 1743

AVIATSIYA I KOSMONAVTIKA

No. 10, October 1982



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#### On the Cover

Outside front--Leaders of the socialist competition communists, military pilots 1st class Captain Ye. Matyukhov (left) and Major I. Nikitin. Photo by A. Kurbatov.

Inside front--The party's combat reserve. Photo by A. Kurbatov.

Inside back--Political workers of the 1980s. Photo by A. Kurbatov.

Outside back--The conquest of space. Illustration by V. Radayev.

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## NAVIGATOR SCHOOL SOLVES TRAINING PROBLEMS ON SCIENTIFIC BASIS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 18-19

[Article by Maj Gen Avn V. Shabanov, military pilot 1st class: "A Scientific Approach at the Basis"]

[Text] What should today's and tomorrow's engineer-navigator be like? What must we do to achieve all-out improvement of the quality of his professional training and ideological-political indoctrination? Answering these questions is the main direction of the life and activities of the Chelyabinsk Higher Military Aviation School for Navigators imeni 50-Letiye VLKSM.

The demands on training quality and effectiveness are growing with every year. Growth in the volume of special knowledge means that cadets must be provided the possibility for firmly assimilating it within the apportioned time. Together with the growing complexity of the flight training tasks, all of this forces the command, the navigator service and the school's teachers and flight instructors to constantly seek ways to improve the training process.

Here is an example. An increase in the norms for total and solo flying time of each cadet did not produce an anticipated improvement in aerial skills. Why? To answer this question, the command conducted a deep and comprehensive analysis jointly with the school's navigator service and instructor staff. The conclusion was obvious: The existing logical structural system of preparing cadets for flying followed by the flight training section had to be changed.

For a number of years, preparation of cadets for flying was thought to be the job of the instructor. The explanation for this premise was that the instructor had a good knowledge of the theoretical course and that he possessed considerable living and flying experience in navigator positions. He was the central figure of the pedagogical process and of preparing the cadets for flying.

Having carefully studied the materials of the analysis we came to the conclusion that the navigator-instructor should have the main role in preparing cadets for flying in the flight training section, because he is the one responsible for the flight training of cadets in the air. Let me note right away that such an approach does not in any way diminish the role of the instructor in preparing

cadets for flying. As before, he actively influences the students, teaching them to solve navigation problems in the course of integrated training exercises.

Working out the flying assignments, analyzing previous exercises, training with the navigational apparatus and rehearsing the flights are responsibilities imposed upon the navigator-instructor, to whom a flight group is assigned at the beginning of the school year. We fill this position with navigators having 1st class qualifications, and we turn special attention to improving their training techniques and their theoretical proficiency. For this purpose we organize and conduct special lessons to which we invite experienced officers of the flight training and methodological sections and the air training regiment.

A creative solution to this problem has already produced positive results: Good feedback has appeared, making it possible to promptly correct the orientation of the training on the basis of the flight results. The innovation is making it possible for us to tie the tasks of general navigator training in more closely with the flying and to achieve greater concreteness and purposefulness. But in my opinion the main advantage of the new training approach is that the person directly responsible for the flight training of the cadet in the air now rehearses the forthcoming flight.

We view flight rehearsal as a form of imitative simulation which has a significant influence upon the professional qualities formed within the future air warrior. In this case under the instructor's guidance the cadets do the work of a crew navigator in accordance with the existing regulations, they evaluate the actual navigational-tactical situation as it evolves, and they make decisions having to do with the actions they will take. And in order that such rehearsal could become a model of the real flight, the instructor comes to the aid of the navigator-instructor together with all of his knowledge and flying experience.

The command and the political section of the school are persistently monitoring the military development of the school's graduates, reacting very attentively and self-critically to remarks coming from the line units. Each year an executive group studies the progress made by our graduates in working themselves into the unit and in performing their official activities. Collective and individual discussions with graduates and with the command and political staff of the units are making it possible to reveal and generalize the best experience, and to find new forms and methods of training and indoctrination and the negative sides of the professional and moral-political training of the cadets.

The facts that are obtained are thoroughly analyzed and discussed by the school council, after which a decision is made.

As an example, comparing the results of personal contacts with unit executives and opinions voiced concerning our graduates, we established that they do not have an adequate knowledge of the documents that regulate flight work. The school board quickly implemented a number of measures to correct this deficiency in the professional training of the cadets. The flight training section has now developed a procedure for systematic testing of the cadets' knowledge of the existing manuals, and the procedure is now being tried out.

It may now be divided conditionally into three phases. In the first, assimilation of the basic premises of the documents, as explained by the instructor, is tested. This phase of the procedure uses "programmed lessons" designed to be used without computer assistance. In the second phase the independent effort of the cadets to study the existing regulations is subjected to quality control. This phase is based on the "programmed problem method," and it requires the use of computers. The third entails complete testing of the knowledge acquired by the cadets; in this phase the instructor questions the students individually or gives them written tests. In addition the third phase is repeated by the flight training staff when cadets arrive at the air training regiment.

The training regiment's flight instructor staff plays a special role in improving the professional qualities of the navigator-cadet and in his training and indoctrination. Flight training practice has shown that cadets achieve high grades in aerial skills and in their moral-political and psychological training in those subunits where unweakening attention is devoted to the selection, training and indoctrination of flight instructors. An example of this can be seen in the results achieved in the squadron led by Lieutenant Colonel Yu. Salygin.

The creative, purposeful activities of the command, of the party and Komsomol organizations and of the entire military collective have laid a strong foundation here for successful work. Each month the squadron wins first place for its total indicators of combat and political training. The cadet flight training plan is fulfilled rhythmically, with high quality. Problems associated with upgrading the qualifications of the flying personnel are solved completely and promptly, and young pilots and navigators are worked in. The squadron's flying personnel boast the highest level of aerial skills in the school: All craft commanders are capable of flying under minimum weather conditions in daytime, and most can do so at night.

These results are mainly the product of the fact that the tone of the work is set by Lieutenant Colonel Yu. Salygin, by the squadron navigator Major V. Voronov and by the deputy commander for political affairs Major N. Nesmiyanov, who are typified by a scientific approach and a business-like attitude toward all problems, and by a desire to fulfill all of the cadet professional training tasks in strict correspondence with the requirements of the documents regulating flight training and flight safety.

In my opinion a scientific approach to the work means objective and comprehensive evaluation of the present state of affairs in the subunit, and provision of precise, accurate and prompt information. Competent planning, high exactingness and the adherence to party principles displayed by the squadron's officers have created the conditions for rhythmical flight training, and this in turn has made it possible to devote more attention to indoctrinating the future navigators and to implementing successful measures to prevent near-accidents in the air.

The efficiency of the squadron's executive staff is also manifested in its ability to organize the work of subordinates, to distribute working time



efficiently and thoughtfully and to concentrate attention on the main things, though without letting routine matters slip by. Every commander and chief in the subunit has an excellent knowledge of the working qualities of his subordinates, and he is able to correctly organize his system for testing them and providing prompt assistance in their activities. Much attention is devoted here to purposeful flight instructor training. In this case special emphasis is laid on the quality of the ground, preliminary and preflight training provided to cadets. Thus for example Major V. Voronov was able to focus the attention of his navigator-instructors on the particular features associated with teaching cadets just before their first flights. This effort has produced positive results.

A similar effort that was conducted formally in another squadron produced poor results. Inasmuch as the instructor staff did not completely clarify its role in ground training, it approached the training of the young navigators with the same yardstick applied to cadets undergoing their final phase of training.

Individual work with cadets is held in esteem in Officer Yu. Salygin's subunit. The squadron commander invariably coordinates the plan for such work with the instructors, with the line unit commanders and with the party and Komsomol active members. Thus it is no accident that many aircraft commanders have achieved major successes in cadet training and indoctrination, and that Major Yu. Pechkurov, captains V. Malyshev and S. Derbenev and Senior Lieutenant V. Shumeyko have been referred to as the cream of the crop. As soon as the cadets begin to fly, they impart a love and respect of the laws of flight service to them, and they teach them to strictly fulfill the requirements of the documents regulating flight work. They have a personal example in Lieutenant Colonel Yu. Salygin, who not only knows the requirements of these documents well, but also persistently implements them.

The commander believes that the best way to insure flight safety is to reveal the causes behind mistakes and shortcomings and to correct them promptly. He makes broad use of objective control resources for this purpose. Tape recordings are regularly analyzed in the subunit: The flight commander monitors the work of craft commanders, the squadron deputy commander monitors the work of flight commanders, and the squadron commander monitors the work of his deputies and one of the flight commanders.

Nor should we fail to mention the work being done with junior commanders of the class divisions and with senior flight groups. After all, it is upon this category of servicemen, as well as upon communists and Komsomol active members that the flight personnel rely in their indoctrination efforts. A worthy example is offered by the chief of one of the companies, CPSU candidate Cadet A. Bortsov. He is exacting toward himself and his subordinates, and he has earned the authority which he exercises over them.

Conducting commander training, Officer Yu. Salygin constantly relies upon the party and Komsomol organizations. The vanguard role of communists in the fight for flight safety and for improving the flight and instructor training of different categories of officers is regularly discussed at party meetings. Lieutenant Colonel Yu. Salygin has recently been promoted.

In my opinion, if all subdivisions of the school are to work rhythmically, we must focus special attention on working out and implementing the plan for the training process as a whole. We can confidently say that if a planned system exists, the work will be successful and productive. Otherwise crash campaigns, haste and countless and unproductive attempts to find the causes of setbacks would be inevitable. To summarize, we could reduce such a system of training future navigators to the following: correct explanation of the immediate and long-range objectives, careful choice of forms and methods which would make it possible to complete the training and indoctrination tasks in the best way possible, and selection of executives capable of implementing decisions in exemplary fashion.

Guiding themselves by the historic decisions of the 26th CPSU Congress, the requirements of the decrees of the CPSU Central Committee and the USSR Council of Ministers, and the orders and directives of the minister of defense and the air force commander in chief concerning effective improvement of the quality of officer theoretical and practical training, the commander, the political section, the instructors and the flight instructors of the school are continuing to improve the aerial skills of the cadets and the methods used in all forms of studies, on the basis of complete and high-quality fulfillment of training plans and programs.

Preparing for the 60th anniversary of the USSR's formation, the school's personnel are fully resolved to implement the extensive programs of improving the training base and the preparation provided to the instructor staff, of improving the training of the flight instructors of the air regiments, and of raising the effectiveness of party and Komsomol organizations.

The triumphant day on which former cadets, having passed their state exams, will don their officer's uniform and depart for their air units is coming near. And the quality of the work being done by the great collective of this navigator school, one with a very long history, is being tested out there, in the troops. In order that it would be recognized as high, we must constantly arm ourselves with all of the best, and every day we must improve the methods of preparing navigators devoted to the Soviet motherland for our glorious air force.

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## STRONG IDEOLOGICAL INDOCTRINATION IN FACE OF 'CAPITALIST PROPAGANDA' STRESSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 10-11

[Article by Col V. Makeyev, chief, propaganda and agitation section, deputy chief, Air Force Political Directorate: "The High Effectiveness of Ideological Work"]

[Text] "The course of the country's economic, sociopolitical and cultural development, full realization of the possibilities of developed socialism, implementation of the Soviet Union's Leninist foreign policy course and reinforcement of its international positions are depending more and more on the successes of ideological work and political indoctrination."

From the CPSU Central Committee  
decree "On Further Improvement of  
Ideological Work and Political  
Indoctrination."

The 26th CPSU Congress deeply and thoroughly examined the problems associated with organizing and conducting the party's ideological and political indoctrination activities. The fundamental premise that communist indoctrination of the Soviet people requires qualitative improvement in the conditions of developed socialism has enjoyed further development. These requirements, it was noted in the accountability report of the CPSU Central Committee to the 26th CPSU Congress, are the product of a change which has occurred in the historic conditions under which our society is developing, of the peoples' higher level of culture and education, of their greater spiritual demands and of expansion of the arsenal of our propaganda and agitation resources.

On the other hand these requirements are also elicited by significant intensification of the activities of imperialism's subversive propaganda centers.

"Are all of these new phenomena and circumstances being accounted for in due fashion? Are the enormous possibilities of our propaganda being utilized to their full extent?" asked CPSU Central Committee General Secretary Comrade L. I. Brezhnev. "There can be only one answer to this question: No, not to their fullest.

"On this basis the party Central Committee formulated the objectives of improving ideological work and political indoctrination. They are spelled out in the 26 April 1979 decree of the CPSU Central Committee. This document is intended to be a permanent guideline.

"What we are essentially talking about is reorganizing...many sections and spheres of ideological work."

Reorganization of ideological work in modern conditions is dictated primarily by the objective needs of developed socialist society and by concern for insuring its progressive development toward communism. Its need has also been elicited by change in the very object of indoctrination--the individual, who already embodies many of the traits inherent to the man of the future. And finally, reorganization of ideological work, especially in the USSR Armed Forces, is associated with sharp aggravation of military-ideological confrontation between socialism and capitalism, with the need for preparing the personnel for the harsh trials of war, were it to be imposed upon us by imperialist aggressors.

This is why it is especially important today for every Soviet individual, including every defender of the socialist fatherland, to deeply recognize the close relationship between his vital interests and implementation of the party's plans and of the decisions of its 26th congress and of subsequent plenums of the CPSU Central Committee. It is important for every Soviet citizen to make a personal contribution to their implementation. It is at this that all of the political, organizational and indoctrination work of commanders, political organs and party organizations and of all of our party propaganda and agitation is oriented.

Reorganization of ideological work under modern conditions, it has been noted in the post-congress speeches of party and government leaders, should not be interpreted as some sort of dismantling or fundamental restructuring of all of our ideological work. We must do the maximum to preserve all that is valuable and positive, and account for both the new phenomena of life and the richest traditions and the many years of the party's experience in this area. But at the same time what we need is not the appearance of reorganization but a reorganization in fact, one that would insure a qualitative rise in the level of ideological work and all of its spheres and sections.

Ideological work is a living, creative thing. In its course, many valuable, interesting ideas are born. These ideas must be constantly studied, they must be carefully weighed on the strict scale of practice, and they must be disseminated more broadly. This also pertains fully to the activities of commanders, political organs and party organizations of the air force.

Owing to unweakening attention and concern of the CPSU and Soviet government, the air units are receiving more and more sophisticated weapon systems and modern flight control and support resources. And yet the main and decisive strength of the air force lies in the people handling this menacing armament. Implementing a scientific, integrated approach to indoctrination, the commanders, political workers, and party and Komsomol organizations are promoting further



growth of the ideological maturity and political activity of the airmen. Ideological life in the troops has risen to a new, higher level on the basis of the CPSU Central Committee decree "On Further Improvement of Ideological Work and Political Indoctrination." It is oriented on improving the aerial skills and flying proficiency of the motherland's defenders, and on raising their sense of personal responsibility for fulfilling military duty. The task now is to persistently seek and find those forms of work which would produce the best impact. And this means that the air force units and subunits must carefully and scrupulously approach the organization of all political propaganda and agitation organs, competently coordinate the efforts of different categories of ideological workers and make maximum use of their strong sides. It is no less important to make sure that every communist at the grass-roots level, no matter where he may be, would constantly feel himself to be a political champion of the party, and would recognize that it is precisely through him that the party maintains its unified and integrated approach to indoctrination.

The Communist Party teaches us that we must universally and thoroughly analyze the evolved situation in different areas of ideological activity with the purpose of reinforcing all of the positive and discarding all that reduces the effectiveness of the work. The party also teaches us that we must show constant concern for the quality and content of ideological indoctrination measures. In this connection we need to make fuller use of television and radio, of periodicals and of the possibilities provided by officers' clubs, clubs and libraries in indoctrination of the airmen.

Completion of the complex and important tasks posed by the 26th CPSU Congress in relation to ideological work requires political organs and party and Komsomol organizations of the air force to concentrate their attention on its main directions and to persistently shape an active life position in the defenders of the motherland's skies--one in which the unity of word and deed would be the daily rule of their behavior. We are obligated, emphasized Army General A. A. Yepishev, chief of the Soviet Army and Navy Main Political Directorate, to raise the level of ideological and theoretical training of communists, and to increase our attention to every form of party study and of political and Marxist-Leninist training, and to the quality and effectiveness of ideological measures. This is the area of work for which the entire apparatus of the political organs and the entire staff of the party committees and party bureaus are responsible.

Fulfilling the decisions of the 26th CPSU Congress concerned with reorganizing ideological work, air force commanders, political organs and party organizations are directing their main efforts at completing the tasks posed in the CPSU Central Committee's 26 April 1979 decree. As we know, these tasks include: insuring a high scientific level for propaganda and agitation; increasing the effectiveness and concreteness of propaganda and agitation, and its relationship to life and to solving economic and political problems; developing the aggressive nature of propaganda and agitation.

A high scientific level has always been and continues to be the most important feature of the Leninist party's ideological work. It has risen significantly. Growth in the theoretical level of propaganda and agitation now depends in many

ways on the scientific competency of propagandists, lecturers, agitators and political briefers, the leaders of Marxist-Leninist and political training groups, party educational workers and other workers of the ideological front. This is why it is very important to approach selection and placement of propaganda personnel more attentively and, I would say, more thoughtfully at the present stage. Moreover life persistently demands that they be trained better. This demand can be satisfied not only by military academies and institutions of higher education, advanced training courses and Marxist-Leninist universities, but also regular, effective seminars, briefings and rallies in the units and formations, and daily, concrete assistance to propagandists locally on the part of commanders and political workers.

Deep and comprehensive knowledge, high spiritual culture and the ability to listen to and understand people, to persuade with the power of thought and to encourage them to act by the power of example are the main qualities the party would wish to see in the champions of its policy. The propagandist must always be distinguished by political maturity, by the ability to deeply analyze current events, by an active struggle for Lenin's ideals and by an attitude of intolerance of all deviations from the norms of communist morality.

There are many propagandists in the air force units and formations who satisfy these requirements completely. Among the best are officers I. Ivanov, F. Kurbangaliyev, N. Buyanov and many others. They are looked up to as leaders, and they are imitated.

Various methods are used to train propagandists in the units. Political self-education offices and reference and information centers have been created in the formation political organs, propaganda days are regularly held, and correspondence seminars for propagandists have been organized. Their activities are aimed at spreading the best experience of expert propaganda work and the work experience of commanders, political organs and party and Komsomol organizations associated with transforming the squadron, the detachment and the company into a center of ideological indoctrination.

Insuring a high scientific level in ideological work would be unimaginable without improvement of the leadership of ideological work, without predicting the impact of ideological indoctrination measures and efficiently planning them. Perhaps it might be suitable to create special ideological commissions in political organs and large party committees for this purpose. They could delve deeply into the content of the work being done, evaluate its effectiveness and produce recommendations promoting improvement of ideological, political, military, legal and moral indoctrination of the airmen.

Lenin taught us that ideological work is tied in with life when propaganda and agitation are able to assist in the analysis and revelation of the facts of modern times from the positions of progressive theory and party policy, and when it orients the people toward solving concrete problems.

What this means to today's air force propagandists is to do everything they can to raise their theoretical and instructional expertise, their professional

proficiency and their competency in questions of combat and political training. For example a propagandist in an air regiment wishing to prepare an interesting and useful talk would first have to have a good knowledge of the aviation equipment and armament and the rules of its operations and combat application, and he would have to thoroughly study the guidelines regulating accident-free flying. He must be able to skillfully and competently solve problems associated with providing ideological support to planned flying, to tactical flying exercises, to missile launches, gunnery practices and bombing runs at the training grounds, to combat duty, to housekeeping days and the like.

It would not be too much for propagandists to think about the sociological (personality) charts of the officers--pilots, navigators and other members of the flight and ground crews--reflecting the status and dynamics of the growth of their ideological, political, moral, military and psychological qualities. In my opinion such charts can help the propagandist find the correct approach to people and effectively influence them with party words, the principal weapon of the propagandist.

Finally, the propagandist must know how to use the materials of visual agitation in his daily work in order to mobilize the airmen for high-quality solution of combat training problems.

One of the leading principles of ideological work and its reorganization is, according to the directives of the 26th CPSU Congress, its aggressive nature. Today the party attaches special significance to this principle, because the enemies of peace and socialism have intensified their ideological diversions against the USSR and countries of the socialist fraternity. The U.S. administration and reactionary circles of other countries of the capitalist world are allocating incredible sums to the arms race and conducting brazen anti-Soviet propaganda, taking their justification from the shop-worn slogan of a supposed "Soviet threat." What aggressive ideological work means under these conditions is, first of all, competent demonstration of the achievements and advantages of real socialism and the consistently peace-loving foreign policy of the Soviet state.

As is true in the army and navy as a whole, an efficient system of ideological measures has evolved in the air force. It takes many forms. Included among them are discussions on political topics, political briefings and reviews, lectures and reports and collective viewing of the television programs "Time" and "International Panorama." Unified political days, during which members of the agitation-propaganda collectives appear before the airmen together with commanders and political workers, have proven themselves well.

But at the same time we cannot close our eyes to the deficiencies either. There is much room for the activity of party activists and all communists of the aviation collectives. We must do everything we can to aim the efforts of our ideological personnel and of official and unofficial propagandists toward the key directions of ideological work. Now, at the eve of the 60th anniversary of the USSR's formation, this work must assume its greatest scope.

The training year is coming to an end. The units and subunits are preparing to sum up its results and to plan new goals of military improvement. All successes and shortcomings should be examined in close association with the way ideological work and political indoctrination are organized. Commanders, political workers and active party and Komsomol members must analyze the shortcomings more deeply, generalize the positive advances in this work, and when they organize their activities for the new training year, they must rely on the best experience.

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#### PHOTO-RECONNAISSANCE FLIGHT TRAINING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 6-7

[Article by Lt Col A. Lapshin: "Two Squadrons Compete"]

[Text] "So you want to meet an outstanding pilot?" the regiment commander spoke pensively. "Let's see, I would recommend Lieutenant Colonel Vladimir Nikolayevich Kulikov, the squadron deputy commander. He's a military pilot-sniper. He's a graduate of the Tambov Higher Military Aviation School for Pilots." Following a moment of silence the officer added: "He knows how to work with people. He has helped many pilots. There were even ones whom he literally returned to the sky. They all fly excellently now. And there's more. This subunit has now been competing with a squadron of the neighboring regiment for a long time. After each flight the rivals check on each other's results, and when they meet they exchange their experiences. Go see Kulikov. The commander is now on leave, and he's filling in."

The squadron headquarters was located at the other end of the airfield. The duty officer met me at the entrance to the building and escorted me to the office. An officer stood up from behind his desk. He had a cheerful, hospitable countenance. His clear, straight gaze coupled with a playful twinkle concealed deep in his eyes gave the impression that this was a quick-thinking man, and his perfectly fitting uniform and the confidence and deliberateness of his movements attested to his punctuality, composure and self-exactingness. Kulikov graciously offered me a chair.

We got to talking. When I asked him about the competition between the squadrons, Vladimir Nikolayevich explained with a feeling of deep respect for his comrades in arms:

"Lieutenant Colonel Stanislav Vasil'yevich Kovalenko is a worthy rival. There is always something to learn from him. He was awarded the Order "For Service to the Motherland in the USSR Armed Forces," Second and Third Degree for the successes the collective and he personally achieved in combat and political training. And we have not yet been able to beat our rivals in the socialist competition. But that's all right. Kovalenko's subordinates have been showing us the way. They do not keep secrets, and they eagerly share their experience."

The airmen can remember when the two squadrons worked together at the practice range. Kovalenko's subunit took the lead in points. Later on, when they got together, the officer thoroughly described how they practice the procedures and methods of target approach, and how they coordinate their actions in the air. There was also something to learn from the other side. But in relation to some indicators Kovalenko's rivals are not only inferior but even superior.

"Sometimes I have a hard time defining what we have more of--rivalry or cooperation," Vladimir Nikolayevich smiled. "In any case there can be no doubt as to the benefit to both subunits. For the moment we're following them, as we would a leader, but the gap is narrowing."

He had little to say about his own merits, as if they were unimportant. But there are many episodes in the officer's flying biography worthy of being known:

The assignment was worded briefly: The pair of airplanes was to reconnoiter and photograph the surface-to-air missiles. The coordinates of the search area were given. Only one approach within a strictly defined time interval was to be permitted in the assignment. If they strayed outside the practice range, they would forfeit their points. They were to fly at low and minimum altitude to the search area.

During the preflight instructions the regiment commander once again clarified the features of the assignment and the search method. Everything was clear. The weather along the route was basically tricky. The same was true for the reconnaissance area.

Although many things repeat themselves from one flight to the next, something new and unexpected happens in each of them. This is why each time Kulikov feels a sense of joyful anticipation for a certain while. Such was the case now. But this feeling did not distract him from what was most important. He checked installation of the cameras himself. Then he received the technician's report and inspected the airplane, following all of the rules. Everything was in order.

The inspector took the right seat. His manner was casual, as if he was not paying attention to the actions of the crew.

"Ready for take-off, Commander," reported Captain Yu. Genayev.

"Roger," Kulikov replied.

Respect for his navigator and confidence in him could be sensed in the officer's tone. He was a top-class specialist. They had flown together many times before. Nevertheless, a second later the commander queried:

"Did you check the back-up camera?"

"It's O.K.," Genayev answered.

"Five O Four, start your engines!"

Switches clicked, and a practiced hand grasped the stick.

The grey landing strip, scarred by the signatures of numerous airplane wheels, dropped away beneath the airplane. The long route was ahead.

Low altitude. The scouts maintained a sharp formation. The landscape below was monotonous. Nothing but marshes and a few trees struggling for their existence. Orientation was basically visual. At such a moment the precision with which an aircraft approaches the practice range depends in many ways on the navigator. He handled the instruments nimbly, made his calculations quickly and managed to compare the data with the route drawn on the map. The airplanes went over their reference points with split-second precision.

"Commander, I estimate 10 minutes to the practice range," Captain Genayev reported, and then he added: "Turn right, seven degrees."

Kulkiov banked the aircraft just enough with a calculated movement. It seemed as if the wingtips were going to snag the treetops at any minute, but the craft commander had a perfect knowledge of his airplane's behavior at minimum altitude.

The follower repeated the leader's maneuver exactly. Now the warplanes were on their prescribed course.

As had been decided during preflight preparations, the airplanes began their search independently. The objective had to be approached straight on, since otherwise at this altitude it would not be picked up by the keen eye of the aerial camera.

Who would see the target first? It had to be photographed by at least one of the crews. Were the leader to fail, the follower would have to adjust his course in such a way as to be able to capture the missiles within the field of the camera lens.

The search went on. Suddenly Kulikov started. What's that, over there by the abandoned farm? They were the "enemy" missile launchers. "Can I turn to them soon enough?" The thought seared his anxious mind.

"Five O Five, I see the target. Turn left ten!" the lieutenant colonel commanded. And immediately he turned on the intercom: "Heads up! I'm going in!"

The glassy eyes of the aerial cameras flashed coldly through the open camera hatches.

The inspector attentively looked at Kulikov. It was evident to him that the craft commander had made his decision. But at such altitude and speed, the required turn would put the airplane at the limit of its possibilities.

The pitch scale slipped downward a little on the gyro horizon. Banking sharply, the little airplane silhouette indicated the angle.

"Another two degrees," the navigator prompted.

Two degrees! That was just how much further the airplane could go before reaching the critical bank angle which, if exceeded, could cause the airplane to go into slide that would be impermissible at this altitude.

"Understood, two degrees," the craft commander confirmed in a matter-of-fact way.

Once again the barely discernible movements of the stick. The right wing dipped once again, such that it seemed that its leading edge would strike the ground.

"On course, Commander!" Genayev's voice was calm. He was completely absorbed in his work.

It seemed as if the airplane itself breathed a sigh of relief when the commander brought it back to horizontal flight.

"Navigator, prepare the manual camera!" There was no acute need for it now, but a back-up would not be a hindrance.

The onboard cameras were turned on. No one in the crew could hear the clicking of their shutters, but they were working. Kulikov could feel this with all of his being, with every cell in his body.

The farm and the sharp-tipped missiles, like sharpened pencils, hidden behind the farm buildings flashed by and immediately dropped behind. "What about the follower?" Kulikov wondered. "Did he have enough time to make his turn?"

"Commander, we went over dead center!" the navigator reported. He could barely hold back his joy.

They struck a course back home, their spirits somewhat anxious. What would the film show?

After the airplane taxied to the parking pad and its engines were shut down, the inspector turned to Kulikov and said:

"You acted competently in the situation that evolved. Your grade will depend on the results of the photography."

Soon the specialists reported:

"The quality of the film is excellent."

The squadron commander and deputy commander for political affairs were the first to congratulate Kulikov on his success.

Time passed. One flight superseded another, but the results never changed: They were always high and stable. In a little while the insignia representing



the highest aviation qualification, "Military Pilot-Sniper," came to rest on the right side of Lieutenant Colonel Kulikov's flight jacket. Many of the officer's subordinates also upgraded their class qualifications at that time. Communist Kulikov was directly responsible for this.

It is now the rule for the unit staff to send "impossible" pilots to this squadron, because it was certain, not without grounds, that Kulikov could straighten them out.

Once the regiment commander summoned Lieutenant Colonel Kulikov.

"Vladimir Nikolayevich," he addressed the officer, "I have already spoken with your squadron commander. I decided to get your advice. Read this," the colonel pushed a sheet of paper toward him. "It would be unsuitable to continue training aboard an airplane of this type...."

"I understand, Comrade Colonel."

"What do you understand?" the commander asked with a smile. "I haven't said anything yet."

"I understand that this pilot needs some training," Kulikov replied.

"Can you do it?"

"I'll try."

They were talking about Senior Lieutenant V. Dubtsov. There were many things that were not falling in place for him, especially taking off and landing. He was much better in the air.

The first interview did not amount to anything. It could be seen from all indications that the pilot was already beginning to lose faith in himself. He answered questions listlessly, but when he heard: "Do you want to fly this airplane?", his eyes opened wide and he answered resolutely: "Yes!" The squadron commander suggested that Kulikov fly with Dubtsov.

A few things came to light with the very first flight. Dubtsov began to show signs of nervousness right from the very beginning of his landing approach. His fingers clutched the stick so tightly that they whitened beneath his nails. His movements became jerky and rough. The pilot constantly moved the stick about, causing the nose of the airplane to lurch in a barely noticeable way. But this lurching gradually grew in intensity.

"He's going to shake the plane apart," the instructor thought. "Should I assume control? No, that's no way to handle it." And so Kulikov addressed his subordinate in a way totally frowned upon by the regulations:

"Volodya."

Dubtsov turned his head to the right and looked at his mentor in disbelief. He was not used to such familiarity.

"Volodya," Kulikov repeated, "let the stick go."

Dubtsov did so, with no less disbelief. But the airplane immediately calmed down.

"See, the plane moves right along on its own, without any help. Just adjust its course slightly and smoothly. Here, watch."

The airplane became amazingly obedient as soon as the instructor took control. Without any apparent effort, Kulikov smoothly deflected the stick to the exact amount required. Dubtsov watched the instructor's actions with delight. He may have heard about the piloting proficiency of his new commander, but this was the first time he was able to see him at work.

"Now take the stick. Follow the long-range homing radio marker beacon. Look: course, landing beam, altitude, speed.... The instruments tell you everything. Just read them and respond."

Telling his student what to do and when, Kulikov prompted him continually until the airplane was on the ground. This is the way it should have been done. And although Dubtsov's landing was not the gentlest, and his landing run was longer than it should have been, after taxiing to the parking pad, Kulikov placed his arm over his shoulder and said tenderly:

"We'll fly together!"

Then followed a meticulous analysis, and training in the cockpit and in trainers. Until total exhaustion. Then there were the test flights, and more training. Dubtsov was not sparing of himself.

Kulikov happily noted every new achievement of his student. The deputy commander for political affairs also provided great assistance to the instructor in this work. Everyone could see that the officer was transforming literally before their eyes, acquiring confidence in his own strengths and sensing his importance to the subunit's overall progress. Dubtsov now serves in another unit. He was promoted, and he recalls his instructor with gratitude.

Lieutenant Colonel Kulikov played a great role in the flying fate of Senior Lieutenant A. Chistyakov and many other pilots. His sympathy, concern, unwavering exactingness and his capabilities as commander and teacher helped. As far as his exactingness is concerned, everyone in the fighting collective knows that Kulikov would never be caught displaying an unconscientious attitude toward service and flying, or disregard of its laws.

There was a good view of the airplane parking pads from the office window. They were frozen in their places in a straight row, as if someone had used a ruler to line them up.

"We have excellent equipment," Kulikov commented on catching my eye. "But what is most important is that the people flying it are worthy."

No matter what we talked about, Vladimir Nikolayevich always channeled the discussion toward the work of his fellow servicemen. He knew very many things about all of them. Who is competing with whom and in what, what their range of interests are, what their traits of character are--both positive and negative, who bears what attitude toward improving his flying proficiency. One other typical trait is that Lieutenant Colonel Kulikov first of all tries to see what is good in every subordinate, and on recognizing this quality, he does everything he can to develop it. He always does this.

His influence upon people is based on his knowledge of their strong and weak sides, on his deep ideological conviction and his strong life position. Add to this his sincerity, a total absence of even a hint of deceitfulness. And thus it is no surprise that the officer's authority is so great and irreproachable.

Could this be the source of the educational strength of the individual approach? Tailoring everything to the individual. Seeing everyone, letting none drop out of sight, and, should anything happen, immediately coming to their assistance.

The subunit recently held a party meeting. In it Lieutenant Colonel Kulikov focused the audience's attention on the vanguard role played by communists in successfully completing the tasks of the new training year.

"Not all of us have become outstanding soldiers yet," he said. "Of course, there are objective reasons for this, but the collective needs an atmosphere in which each person would seek excellence with all of his strength. Otherwise how can we even discuss the setting of examples by communists in raising the squadron's combat readiness? We are now summarizing the initial results of the training year. We must not become self-satisfied with our achievements. We must weigh our possibilities well, and think about how to realize them in the new training year."

The results of the tactical flying exercise in which Lieutenant Colonel Kulikov participated together with the squadron made a significant contribution to the overall successes of the subunit. The exercise situation was complex. The scenario called for redeploying at a standby airfield together with all of the engineers and technicians. But because of bad weather the engineers and technicians, who had taken off just after the crews aboard a transporter, had to land at another airfield. And then, in the evening, the combat crews were ordered to take off. This is where regular training in independent technical maintenance of the airplanes came in handy! The crews themselves checked the equipment, refueled the airplanes and mounted their weapons. The crews of captains S. Polukhin and Yu. Vasin and Senior Lieutenant A. Chistyakov distinguished themselves especially. Their efforts would make war veterans proud. They prepared the equipment for take-off with outstanding quality. It was still before dawn when the bombers took off on their mission. This was a serious test, and the airmen passed it honorably.

Talking about this exercise, Vladimir Nikolayevich dropped into thought. He fell silent for a while, and then he added:

"The cause behind success or failure can be found only in the people, in the way they are trained and indoctrinated, and how high and strong their morale is. And it is very important to recognize and to feel with one's heart that defense of the motherland is the vital duty of each of us."

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## READERS' COMMENTS ON TACTICAL VALUE OF THE PAIR VS THE SINGLE AIRCRAFT CONTINUE

### How to Pose the Question

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) p 8

[Article by Maj A. Plentsov, military pilot 1st class]

[Text] I found Colonel V. Belyayev's article "A Pair or One?" (AVIATSIYA I KOSMONAVTIKA, No 11, 1981) to be interesting reading. The author raises an issue that is probably in the minds of all pilots flying modern airplanes. And it is not an issue which can be resolved categorically by any one pilot.

The second article on this same topic, written by Lieutenant Colonel D. Goldyrev--"The Pair Has a Future" (AVIATSIYA I KOSMONAVTIKA, No 4, 1982), compelled me to take pen in hand. I think that the way itself the question is posed is somewhat inaccurate, though the main line of the debate is evident: What should we consider as the tactical strike unit, the single airplane or the pair?

Moreover in my opinion both articles suffer in that their recommendations are somewhat divorced from the requirements of aviation today and aviation of the future. In addition the authors do not indicate the concrete branch of aviation about which they are writing. And combat application of its different branches depends on their purpose.

Of course, a fighter-bomber can knock down an enemy airplane, and a fighter can annihilate a ground target. But there can be no doubt that fighters will be the ones to achieve superiority in the air. Bomber aviation, meanwhile, is intended mainly for massed strikes for the purpose of annihilating enemy targets on the ground. I am repeating these basic truths in such great detail because before we can talk about combat formations to be used in the performance of missions under combat conditions, we must always consider the concrete branch of aviation and the missions it must perform.

Fighter aviation is clearly implied in the discussion. Therefore, entering this debate, I will limit my discussion to it.

As we know, fighter aviation is intended for attaining air supremacy. What sort of air supremacy could we imagine in a situation where airplanes are

operating on their own? In my opinion when Colonel Belyayev asserted that the modern "fighter can annihilate any airborne target on his own with high probability," he clearly exaggerated the fighter's possibilities. But let us assume that he is right. What if there are many targets to contend with? Moreover the words "targets" and "many" are also relative concepts. They will clearly not be targets like those found at practice ranges, but real enemy fighters that will have to be annihilated in aerial combat. A situation may also evolve in which the probability of being hit by the enemy would be greater.

I am not trying to be a defeatist. As a counterweight to Colonel Belyayev's conclusion I simply would like to say in all seriousness that in modern aerial combat one (or even several) fire and tactical unit would perhaps not be enough to really achieve superiority in the air. What we need here is not a pair, but that quantity of airplanes which could crush, paralyze, disorganize and, in the final analysis, annihilate the enemy.

I think that in modern aerial combat, the single airplane, being a favorite target of enemy fighters, may be annihilated before it is even able to start its mission of attaining air superiority.

Let me now go on to Colonel Goldyrev's article. It could be said, at least in my opinion, that from a philosophical point of view he correctly defined what a pair is. But there is one question I would like to ask: In what manner, presuming "presence of stable, significant and frequently repeating relationships between phenomena," will a pair fulfill its mission during the day in clouds or at night in any conditions?

The experience of using aviation in local wars unleashed by imperialist countries, and flight training itself tell us that approximately three-fourths of all combat or combat training missions are performed mainly in adverse weather day or night. The side with flight personnel trained better for action in such conditions and with airplanes outfitted with the more sophisticated equipment will have the advantage over its opponent.

The author made a reference to the onboard sights of modern fighters, which "permit followers to maintain prescribed parameters of the combat formation in the absence of direct visibility" (I have been flying in fighter aviation for 10 years, and I have never flown in formation in this way yet). After all, by turning on his onboard sight to find the leader or to maintain his place in combat formation, the pilot clearly exposes his airplane, making it possible for the enemy to detect its location, jam the emission channel or launch a missile.

Colonel Goldyrev's second conclusion in favor of the pair--"a need has arisen for 'redistributing' the information load between the crews"--is generally incomprehensible to me. Perhaps the author will explain it in the future. As for the rest concerning the pair and its combat application during the day in simple weather, I am in agreement with the article's author.

Of course, a modern fighter is capable of performing some contemporary missions both as a single fighter and within a pair. I do not think that we can disregard this fact. But from my point of view, in a discussion of such seriousness,

we cannot ignore massed use of aviation in large groups in all weather either. What we especially need here is constant fire and tactical coordination not only between airplanes, pairs and groups of airplanes but also with ground antiaircraft resources in the region of combat, and extensive application of all possible forms of interference. The possibilities of long-range use of onboard armament coupled with a sharp transition to close aerial combat and many other factors compel us to seek ways by which to continuously control every crew within a group, to permit quick decision making on the basis of an analysis of the situation actually evolving and to competently organize and use groups intended for different tactical purposes in the course of combat depending on the weapons they carry.

#### But Still, the Pair!

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) p 9

[Article by Col V. Opalyuk, military pilot 1st class]

[Text] The article by Colonel V. Belyayev, "A Pair or One?" published in AVIATSIYA I KOSMONAVTIKA, began a debate on the question as to the suitability of preserving the pair of fighters as the basic fire and tactical unit. The greater combat potentials of modern air weapon systems resulting from the scientific-technical revolution served as the material foundation for the author's doubts and proposals. Challenging V. Belyayev, Colonel D. Goldyrev finds substantial arguments in favor of the pair as the combat unit. I think that the pair not only can but also must be preserved. Moreover the pair must be strengthened with regard to development of aviation technology.

The shield and saber are, I would say, a pithy and eloquent comparison for the pair. But Major S. Murav'yev makes the pertinent observation that this comparison presupposes an identically high level of professional training of both pilots of the pair today. But what if such training is not available yet? After all, attainment of such a level requires time, and thus a situation where the follower takes the lead in a combat formation is more the exception than the rule (Major A. Zheltikov notes in this regard: "The pilot flying in front is the leader as the rule....")

Near-accidents in which airplanes come close to colliding in the air during group flying are validly referred to as disgraceful. And when such near-accidents occur, as a rule they are the product of the grossest violations of the laws of flight service and organizing, preparing and conducting flights by commanders and pilots. An analysis of the causes of such near-accidents would demonstrate absence of constant control on the part of the leader in relation to the location of the follower and his actions during maneuvers within the combat formation, incompetent actions by the follower when attempting to close in with the leader, loss of sight of the latter, and in summary, "a careless attitude," "irresponsibility," "lack of control," "unprincipled behavior" and so on, against which it is hard to argue. But at the same time, when we consider this conclusion from a philosophical standpoint, it concerns mainly the ideal. The material foundation of safe flying, meanwhile, is represented mainly by the training level of pilots engaged in flying (especially group flying).

This is precisely where, I think, the contradiction between development of aviation and the evolved viewpoints on the elements of the combat formation began to evolve. As we know, prior to introduction of radio as a means of control, the place of the commander as the group leader was determined logically by his personal example and by the maneuvers of his airplane. This was the sole possibility of controlling the formation. The appearance of radio made it possible to approach the location of the commander in the overall combat formation with greater flexibility, but in the beginning there was obviously no need for considering this question, inasmuch as piston-engine airplanes, with their low acceleration and low inertia, did not produce special difficulties in formation piloting.

But swift development of aviation in the postwar years introduced a number of unique features to the piloting and operation of modern airplanes. Let us examine some of them.

Structural features: Of their great diversity, we should emphasize the greater difficulty of performing the functions of the leader. One of the main responsibilities of the latter is to be aware of the position of the airplanes in the formation (in the combat formation) and monitor the actions of his followers in flight. It is precisely upon fulfillment of this responsibility that safe group flying depends in many ways. But sometimes he is unable to perform this function owing to the design of the cockpit, the limited possibilities of control, and the use of high-altitude gear which restrains the movements of the pilot to a certain extent. The situation changes completely when we locate the leader somewhere inside the combat formation (at the location of the present-day follower). In such a situation, fulfillment of all of the other of the leader's responsibilities is in no way encumbered.

Power factors: Because the thrust-to-weight ratio of modern airplanes is so high, even insignificant changes in operating conditions (within the limits of several divisions of the turbine rotor rpm indicator) within the operating range of the engine can cause significant changes in its thrust. If we also consider the greater inertia of airplanes, it becomes clear how precise the work of the follower must be to maintain his place in the formation.

Training factors: Paradoxical though it may be, it is a fact: Younger, less-trained, less-experienced pilots must perform the most complex elements of group flight as followers in a group combat formation.

Every pilot knows how difficult it is to take aim, to determine the moment of fire, to execute a bomb run and to simultaneously keep one's place in a combat formation. This is why we come across the extreme cases: The combat formation is maintained, but the target is missed, while on the other hand the target is hit, but the recovery from the dive violates the safety rules, for example in the case of an abrupt turn following a dive.

Naturally such mistakes are the product of the pilot's insufficient attention volume, something that is acquired after many years of flying experience. In subunits manned by young pilots, the demand for achieving coordination in pairs, flights and groups in shorter time somewhat exceeds the possibilities. And quite naturally, I am sure. Therefore it would be more suitable in this case



to afford the young pilot flying in front the possibility for maneuvering in the individual manner in which he had been trained, though under the constant observation of the commander, who must be prepared to provide him the necessary assistance at any moment with the appropriate command.

The following sequence of training would appear logical for a developing pilot: substantial solo training, training as a group member at the location of the present leader, and then assignment to a position inside the combat formation. Each of these training levels would be associated with a different class rating. In this case we could significantly reduce the amount of time and effort expended on raising the battleworthiness of units and subunits containing many young pilots, and we could make fuller use of the potential pilots acquire in school. I feel that this approach could go a long way in solving the problem of group flight safety.

Tactical factors: Now that modern weapon systems are outfitted with sophisticated sighting and navigation equipment, and the different elements of flying are automated, the possibilities of pilots have become equalized to a certain extent in terms of, for example, the accuracy of piloting, target approach precision and so on. This makes it possible for the leader to perform his mission from inside the combat formation without detriment to the quality of the group mission, and to follow the principle that holds in aviation as well: "I see, I control (responsibly and throughout the entire flight), I annihilate."

Naturally my arguments and proposals cannot hold uniquely and categorically in relation to the entire diversity of conditions in which flying proceeds. What I am arguing for is more flexible evaluation of these conditions and capitalization upon the broader possibilities for initiative enjoyed by commanders organizing combat training. What I am arguing for is organizing and conducting group flying on a more qualified basis.

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## IMPROVING THE MORAL, PSYCHOLOGICAL STATE OF FIGHTER PILOTS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 16-17

[Article by Guards Lt Col G. Vasil'yev, military pilot 1st class: "The Main Criterion of Quality"]

[Text] The intensity of the flying climbed. One after the other, the supersonic MiGs rose into the air. Pilots of Guards Lieutenant Colonel S. Bezlyudnyy's squadron practiced intercepting airborne targets and the actions of fluid combat. Komsomol 19th Congress delegate Guards Captain V. Bychkov, officers V. Yashkin, V. Solov'yev, A. Artyushkin, N. Lavrenkov and others were among those who completed their missions with a high score. The subunit received an outstanding score on the basis of its general results.

This has become the rule for this friendly, unified military collective. Having joined the socialist competition for an honorable welcome to the 60th anniversary of the USSR's formation, the squadron personnel are persistently improving their occupational skill, and they are learning to strike the enemy's vulnerable point with the first attack and the first missile. Summarizing the results of the training year, we can note with satisfaction that in relation to many of the indicators of combat and political training, the squadron now occupies the leading place in the regiment. Things are not going badly in the other subunits either. It is pleasant to note that the young pilots are doing just as well as their senior comrades. The Komsomol members are marking the 54th anniversary of the Komsomol with good military achievements. The latter have become possible in many ways owing to the active, purposeful work of the unit's communists.

The regiment's party organization constantly keeps growth in personnel training quality at the focus of its attention. Party influence is manifested mainly in the profound awareness every airman has of the tasks associated with improving his combat proficiency for the day, the week, the month, the training period and the year. This control is achieved through individual interviews with pilots and technicians conducted by political workers and party activists, and through regular reports from the communists on their flight training. This produces good results.

At one of the party meetings, in which the vanguard role of communists in raising flying and tactical skills was discussed, proposals were stated for improving

the preparation of pilots for group flying. These proposals were heeded by the squadron commander, military pilot 1st class Guards Lieutenant Colonel S. Bezlyudnyy, by his deputy commander for political affairs, military pilot-sniper, Guards Major A. Gun'ko, and the squadron's party bureau secretary, military pilot 1st class Guards Captain N. Lavrenkov. Having thought out and weighed everything carefully, they made concrete decisions in unison. Thus several sorties began to be planned specifically for practicing group flying tasks. The first was flown by experienced airmen, and the next was flown by pilots doing such an assignment for the first time. Moreover the time interval between sorties was set in such a way that every airman would have a possibility for sharing his impressions with his comrades after a flight, and warning them of possible mistakes. As a result all pilots now perform the missions with high quality.

Commanders, political workers and party activists have begun devoting more attention to training quality and to analyzing the moral and psychological moods of every air warrior. It is with this purpose that pilots, especially the young ones, are regularly questioned concerning their knowledge of the order and sequence of performing flying assignments and actions in unusual flying situations. Opportunities are also provided to the regiment's masters of combat application for exchanging their experience. For example during preparations for one of the flying days political worker military pilot-sniper Guards Major A. Gun'ko spoke to the young airmen who were to engage in some complex piloting within the zone for the first time. He recalled to them the procedures, the causes behind the mistakes that can arise, and the methods of correcting them.

Another time Guards Lieutenant Colonel S. Bezlyudnyy and Guards Lieutenant Colonel A. Bokach, a party activist and a military pilot-sniper, told the pilots how to simulate aerial combat. Then the plan for simulated aerial combat in the squadron was drawn up in its final form, and the different variants of attack were thought out. The pairs and flights worked out their actions with diagrams and trainers, and they rehearsed their forthcoming flight at the airfield using a simulation procedure.

Party bureau secretary Guards Captain N. Lavrenkov distributed the work of the active party members in such a way that each phase of the training was under the control of the communists. The bureau organized an experience exchange and help for young airmen beforehand. Such purposeful work also had an effect on the way the exercises were performed. The squadron personnel received a high score. Nor did airmen of other subunits fall behind. Fulfilling their socialist pledges, they hurled every projectile and every missile right into the target.

The party organizations are also showing concern for the leisure time of the personnel, turning attention to the mutual relationships existing in the airmen's families. Experience has shown that this is one of the very important and necessary directions of party-political work. It is precisely owing to the assistance of active party members that we have managed to normalize the situation in some families and to create a healthy moral climate within them. The party committee has encouraged the women's council to participate in this work as well. As a result undesirable consequences have been averted both within the family lives of the officers and in their official activities.

Fulfilling the requirements of the orders and directives of the USSR minister of defense, the chief of the Soviet Army and Navy Main Political Directorate and the air force commander in chief, and recommendations of the Sixth All-Army Conference of Primary Party Organization Secretaries, the regiment's communists are focusing their efforts on raising the responsibility of each party member for complying with the laws of flight service and preventing cases of carelessness and negligence. This work entails explaining the particular features of the missions of a forthcoming flight shift to pilots, engineers, technicians, junior air specialists and soldiers of supporting subunits, briefing the airmen concerning their responsibilities, and monitoring execution of these responsibilities. This work is being conducted systematically and purposefully.

During the flying, active party members brief the personnel on the results of the first and subsequent sorties and on the quality with which aviation equipment is prepared for turnaround sorties. This insures visibility in the competition among crews. Active party members utilize flight recorder data and they organize post-flight exchange of opinions among pilots for this purpose.

Party-political work conducted during flying devotes a great deal of attention to the flight control group as well. As a rule party activists hold individual discussions with all officials on the eve of the flying day and, if the possibility allows, during the flying day itself: The details of the missions are worked out, measures aimed at preventing violations of documents regulating accident-free flying are determined, and the need for maintaining an objective approach to evaluating controlled flight elements is recalled.

It should be noted that the regiment's communists have done a great deal, but they still have much to do. We still have shortcomings in the planning of flight training and in the work of specialists of the air engineer service. The command and the party organizations are aware of these shortcomings, and they are taking specific steps to correct them. Not that long ago, for example, additional lessons and advisory sessions were created for technicians on recommendation of the party committee. Members of the agitation-propaganda group conducted interesting discussions with young officers on the design and operational features of the weapon systems. And then things began to go better.

In our efforts to determine effective forms of party-political work, we try to make full use of the experience gleaned at the Sixth All-Army Conference of Primary Party Organization Secretaries. Speaking at this conference, CPSU Central Committee Politburo member, USSR minister of defense, Marshal of the Soviet Union D. F. Ustinov emphasized that the influence of party organizations "must manifest itself in the concrete training results and combat readiness of the army and navy. These results are the main criterion of quality of the work of party organizations and of their contribution to the overall cause of strengthening the country's defenses." This is exactly how our unit's communists are trying to act.

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## FLIGHT TRAINING FOR SNOW CONDITIONS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 34-36

[Article by Pilot 1st Class N. Potapov: "In a Snow Vortex"]

[Text] In winter, following abundant snowfall in the presence of unstable and weak winds, there are certain difficulties associated with taking off and landing in a helicopter, especially on unprepared pads, owing to formation of snow vortexes. The problem is that the snow cloud which forms around a helicopter as it takes off or lands sharply worsens visibility and makes visual contact with ground reference points difficult. And although the physics of vortex formation have been studied well, and effective recommendations have been developed for personnel instruction, the probability of encountering dangerous situations does exist. The reason for this lies mainly in the fact that some pilots do not have a sufficiently clear idea of the physical essence of the phenomena and the complexities it elicits.

An analysis of near-accidents, their causes and the nature of the evolving events would lead to the following conclusions: Dangerous situations arise as a rule owing to prior deviations in piloting techniques or violations of flight rules; the most typical mistakes in this case are haste or risky, ill-conceived decisions and actions; the development of events and the flying results are practically the same for both experienced and young pilots, since the disappearance of the habits of piloting in a snow vortex and the absence of these habits in the first place both lead to the same situation; the probability of greater complications is higher during take-off, though the techniques of take-off and landing in the presence of snow vortexes differ insignificantly; the absolute majority of most critical situations arise during take-off in the zone of influence of the air cushion when the power reserve is inadequate; in all cases the situation is aggravated owing to incorrect interaction among crewmembers.

The physics of snow vortex formation are not complex. When the main rotor is turning near the ground, the inductive air current it forces downward meets with the underlying surface and places weakly secured surface layers of dirt (snow) into motion. As a result a local area of limited visibility, referred to as the snow vortex zone, forms around the helicopter. This is a vortex torus with its center coinciding with the axis of the main rotor and with its

perimeter about one diameter away from its axis. Within the vortex zone the snow mass is distributed nonuniformly, and therefore we commonly distinguish between areas of sufficient and limited visibility. The former occupies the inside zone of the torus, equal to three-fourths of the main rotor diameter. It is characterized by somewhat stable visibility. The second zone is a vortex core equal in dimensions to one-fourth of the rotor diameter, and it is characterized by the poorest visibility.

The intensity of vortex formation depends on the power of the inductive current created by the main rotor (by the engine and main rotor operating conditions) and by the quantity of snow placed into motion. The more powerful the inductive current and larger the amount of snow, the more intense is the vortex formation. From a piloting standpoint the pilot must evaluate this phenomenon in relation to the influence it exerts on his craft's flight. Every helicopter pilot knows that under the same conditions (air current intensity, quantity of snow), the intensity of the vortex may vary depending on the wind situation, the local topography, piloting technique and other factors.

Conditionally we divide intensity of vortex formation into weak, moderate and strong. With weak vortex formation general visibility worsens insignificantly--that is, the horizon or landmarks in front of the vortex can be seen relatively well. In a moderate vortex visibility worsens for a short period of time up to the perimeter of the vortex zone. As a rule a moderate vortex forms in the presence of loose snow more than 5 centimeters deep. In strong vortex formation landmarks lying within the vortex zone disappear from sight. Strong vortex formation can be expected in the presence of loose or freshly fallen snow more than 10 centimeters deep.

Maximum vortex formation intensity always arises whenever a full correction is made to the right, when the craft is moved vertically within an altitude of 3-5 meters, and when the craft is landed, at the moment of final extinction of forward velocity. The spread of the vortex in the horizontal plane depends on the intensity of the inductive air current and the distance to the reflecting surface (the hovering altitude) or, more accurately, on the horizontal component of the velocity of the inductive current, which usually does not exceed 15-20 km/hr. When the helicopter moves vertically, the vortex does not usually rise above one diameter of the main rotor. Practice has shown that an oncoming wind reduces the power of the vortex. Thus at a wind speed of 7 meters per second a snow vortex is felt to have practically no influence upon flight. When a helicopter lands, it enters the vortex zone at a velocity of 10-15 km/hr, owing to which the moving snow mass is decelerated to some extent by the descending air current.

A vortex zone experiences two stages in its existence: development of the vortex formation process, and its attenuation. Attenuation of vortex formation is characterized by stabilization followed by improvement of visibility. The length of the "life" of a vortex depends on the quantity and cohesiveness of snow particles in the snow mass. It does not usually exceed 0.5-1 minute, but it sometimes is more.

The main danger harbored by a snow vortex is concerned with the probability of dramatic worsening of visibility, going so far as to preclude visual orientation

in space. Under these conditions the crew finds itself in a situation where it must shift to instrument flying, and this always involves significant difficulties: The persistent desire to seek out the ground, elicited because it is so close, must be overcome; the inadequate resolution of piloting instruments at low speeds and low flying altitudes generates a lack of confidence; high precision is required in the manipulation of controls.

In such a situation just about every crew finds itself in conditions where the probability of a favorable outcome to the fight becomes highly problematic. The insidiousness of a vortex lies precisely in the fact that one cannot always count on experience. Consequently the main objective is to exclude the possibility of losing contact with landmarks (improving the conditions for maintaining visual orientation in space). This objective can be reached by constant selection (in every flight) of optimum operating conditions, and dependable and simple piloting technique which would minimize the influence of a snow vortex.

The choice of operating conditions is influenced by the wind situation, temperature, air pressure, topography, the nature of the landing pad, the landing weight of the helicopter and the condition of the snow cover. If we consider that most of these factors are determined approximately, we come to realize how much significance there is in the knowledge, abilities, discipline, piloting techniques and experience of the pilot.

Constant attention should be devoted to training crews for flying in the presence of snow vortices; the habits of piloting must be maintained an order of magnitude higher than in the training afforded to crews in instrument flying.

Moreover to raise flight safety it is important to keep landing pads in excellent condition (maintaining their proper dimensions, marking them appropriately, rolling and packing them, installing dependable resources for determining wind speed and direction and so on). It stands to reason that the crews must be briefed on the condition of the landing pad, and the flight leader must be warned to stay alert. At times of abundant snowfall the most experienced specialists must be called in to manage the flying.

Documents governing flight work do not illuminate the entire diversity of situations that evolve under real conditions. And in fact, would it be right to treat as optimum the same conclusions when flying in moderate and polar latitudes, and when flying over taiga landscape or over vast areas devoid of landmarks? More often than not, flight crews encounter situations in which the general recommendations are not only not optimum, but they are also hazardous. Consequently we need special guidelines that account for the unique features in the given locale and reflect the basic typical situations.

In all cases of flight in vortex conditions, the following basic rules, which guarantee reliable and safe piloting of a helicopter in winter, must be observed.

A hovering maneuver (separation of the helicopter from the ground, horizontal and vertical movement) must be started only during the extinction phase of

vortex formation and in the presence of stable contact with ground reference points.

If moderate or strong vortex formation is anticipated, a reserve of power guaranteeing a second attempt at any flight phase with sufficient altitude and acceleration must be insured; in other words the flying weight of the helicopter must be such that it is able to hover outside the zone of influence of the air cushion.

A helicopter should be taken off and landed only into the wind or, as an exception, with an oncoming sidewind of not more than  $\pm 45^\circ$ . In this case the selected orientation must be the most favorable in terms of landing approach and the contrast of the underlying surface.

A helicopter can be accelerated during take-off only when the horizon or landmarks ahead of the vortex are visible, and in the extinction phase of the vortex.

If a helicopter must be landed in an area with few landmarks and poor visibility or in conditions distorting optical visibility (in cases of high and moderate cloud ceilings at polar latitudes)--that is, when difficulties arise in determining the distance to the ground, relative flight speed, degree of ground slope and the attitude of the helicopter, artificial landmarks dropped from the helicopter in a preliminary approach must be employed (contrasting objects or smudge pots).

As they enter into a vortex zone and fly through it, the crewmembers must constantly keep each other informed as to ground visibility.

When flying in times of vortex formation, the crew must perform thoughtful and accurate actions, and abrupt and energetic maneuvers are especially impermissible.

If a crew loses contact with landmarks in a snow vortex, it must immediately switch to instrument flying, energetically raise engine power (without overloading the main rotor) to maximum, maximize the forward velocity and climb, if the power reserve permits this and if horizontal acceleration can be maintained.

A good knowledge of the physics of vortex formation, careful preparation for flying, strict compliance with the guidelines and a serious attitude toward the effort would permit crews to fly a helicopter reliably and safely in winter.

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## NEED FOR IMPROVEMENTS IN TRAINING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 4-5

[Article by Col V. Selivanov, Military Pilot 1st Class: "The Grounds of a Commander's Decision"]

[Text] A pilot and a crew commander must often make deeply thought-out decisions concerning the performance of flying assignments. After all, he bears responsibility not only for himself but also for his subordinates, for the cargo aboard the warplane and for the safe outcome of the flight.

After completing their tactical missile launches and bomb runs at the practice range, the crews led by military pilots 1st class Major R. Pen'kov and Captain V. Kiselev were ordered to proceed to the airfield. The weather worsened dramatically just as the airplanes assumed their landing approach. The crosswind grew stronger. Low clouds rolling in from the sea began to cover the landing strip.

According to the navigator's engineer calculations there was just enough fuel to get to the alternate airfield. But even there the weather was unstable.

The leader, Major Pan'kov, found himself faced by a choice: What should he do? Weighing all of the "pro's" and "con's" and coordinating with the flight leader, he decided to land at the main airfield. This decision was based on his deep knowledge of the professional and psychological qualities of his subordinates, their rich experience and outstanding flight training. The crew landed safely, having demonstrated high skill and coordination.

Mutual trust and proper mutual relationships in the crews played a major role in the flight's successful completion. I would like to dwell especially on trust. It acquires enormous educational significance only if the commander knows the moral, political and working qualities of the soldiers well, and if he knows how to precisely determine who is capable of fulfilling a particular assignment, order or instruction.

As we know, multiple-seat airplanes are flown not only by pilots and navigators but also other specialists. This fact imposes stiff requirements upon the flight participants, their coordination, their mutual understanding, their professional training, their psychological compatibility and their responsibility for the quality of their work.

I recall the following incident. Military Pilot 1st Class Major A. Gorbik's crew was returning from an assignment. The weather was good, and after receiving his data from the navigator the craft commander organized his landing approach maneuver. The flight leader and the duty navigator simultaneously noted on the radar screen that the trace from the airplane began moving in the wrong manner. They transmitted a command to the crew to correct the mistake. The airplane was brought back to its required flight path. But the crew once again violated the approach pattern. A dangerous violation was averted only through the energetic and efficient actions of persons in the flight control group.

An analysis of the violations in the landing pattern revealed that the experienced flight commander had been overtrusting of his navigator, whose calculations he utilized mechanically, without checking them out. The navigator, meanwhile, who failed to account for wind speed, made mistakes twice in calculating the maneuvers. Consider this in light of the fact that the crew had performed such landings before many times under simple and complex conditions.

In these examples both commanders made the decision to land in the same way, but the results were different. Why? First of all there was a difference in the level of the analytical habits of the officers, in their ability to properly estimate the situation and in the nature of mutual relationships existing between commanders and crew members as well as in the quality of preflight preparations.

It has long been known that when proper exactingness is combined with concern for subordinates, and when the work atmosphere is correct right from the very beginning, not only is a favorable foundation created for a healthy climate in the collective, but also effective utilization of every minute of precious training time is insured.

Execution of an adopted decision depends to a certain extent on the moral and psychological preparedness of the crew members for the forthcoming flight. It is not a simple thing to shape emotional stability in the face of various unusual situations and sharp changes in the flying situation. It is difficult for the commander alone to foresee everything. He needs the support and assistance of the party and Komsomol active members. Nothing influences shaping of the character as does public opinion. The force of an order is universally known in the army, but when it is reinforced by the personal example of a commander and a political worker, and when it is maintained by the unity of will and purposefulness of a collective intent upon executing a decision not out of fear but out of conscience, an order increases the resolve and will of airmen tenfold and imparts courage and stability to them. These qualities favorably distinguish aircraft navigators Captain A. Shvalev and Senior Lieutenant I. Kozubenko. They constantly improve their knowledge and occupational skills.

But unfortunately we sometimes see the reverse. Once I was ordered to take Captain V. Sidorov out on a check flight for certification as a solo follower.

The instructor had reported that this pilot had completed his previous flight well. But in this test flight the officer felt tense, and he made many mistakes owing to excessive anxiety. I was unable to certify Sidorov. He did not receive permission for solo flying until later, after he had deepened his knowledge, undergone more training and flown some more check flights. Now he acts confidently in the air, and he is progressing stably in his flight training program.

Aircraft navigator Senior Lieutenant B. Chumak, who had been certified for solo flying, deviated from the required flight path owing to inattentiveness. Despite the extra time he had available, he made the rash decision to correct the mistake by a significant change in course. The craft commander, who did not analyze the navigator's calculations, made the correction, as a result of which he overtook the crew flying forward of him.

In both of these cases the commanders made a certain decision, one on pilot certification in the first, and one on crew flight in the second. And both decisions turned out to be hasty and premature. Of course, every commander wants his subordinates to assimilate the training problems on schedule. This is understandable, but we cannot excuse haste and irresponsibility in crew training.

Air commanders of all the ranks must give orders and organize the work of subordinates every day--that is, they must make various decisions. But it is not enough to just give orders. Their execution must be monitored to the end. This is a requirement of the manuals and of the documents regulating flight work.

Analyzing the most typical mistakes made by officers in a particular period of time, the regiment command decided to thoroughly study the influence of the mutual relationships among the airmen in the crews upon the quality and results of their labor. Thus on listening to tape recordings of the radio exchanges between crew members, and then conducting check flights, the command found it necessary to further reinforce flight discipline, to improve navigator training and to instill craft commanders with high exactingness toward themselves and subordinates. They are precisely the ones, after all, who must make the decisions independently and be fully responsible for the success of an assignment, especially when deployed away from their home base. Therefore when the readiness of crews for complex flights is tested, the regiment regularly tests craft commanders in actions carried out by officials one step higher. Moreover all crew members test each other's knowledge and habits in relation to all phases of a particular flying assignment under the supervision of experienced instructors. Mutual assistance and interaction in the air are worked out in this way.

Flight practice persuasively demonstrates that the outcome of every flight is programmed in the course of preliminary and preflight preparations. The time devoted to such preparations by all crews and subunits is the same, but the results can differ. The results can be predetermined to a certain extent by testing crew readiness, though of course on the condition that such tests are conducted as more than just a formal effort. A good impact is achieved in this

case by assigning an objective score to every crew member. Only those crew members that are thoroughly prepared and whose points add up to a grade of not less than "good" are permitted to fly. The rest are allowed additional time to prepare, after which they undergo meticulous testing. It stands to reason that commanders responsible for such crews are also subjected to the appropriate indoctrination, and their progress reports are heard at meetings of the party bureau.

We know that the main task of the subunit command is to teach craft commanders to prepare crews for flying independently, to make correct decisions and to execute them without delay. I would refer to this ability as a real art. It does not come right away. It requires patient and purposeful training and indoctrination of craft commanders, and meticulous analysis of a mistake, be it even the most insignificant.

We teach craft commanders to deeply analyze not only the positive experience but also the mistakes of their comrades. This approach to the training raises trust, and it instills objectivity and self-criticism. And this is very important. After all, a commander must be able to see everything and foresee everything.

For example at the beginning of the training year the plan for advancement of young crews was threatened with failure owing to poor weather. A solution was found. After special training of the personnel in the techniques of landing at alternate airfields and in the methods of independent aircraft maintenance, a decision was made to fly routes ending up at other airfields. This turned out to be the correct solution. Such flights made it possible to successfully complete the combat training plan, and they raised the confidence of the crews in their strengths.

The commander's ability to act in a quickly changing situation, one in which he must analyze the existing data and make the right decision in short time, especially in his function as a flight leader, deserves special attention. Assume for example that the weather improves just as adverse weather training is about to begin. What to do? I know from my own experience that this is a very annoying situation.

In such a situation the commander very much needs the sensible wisdom not to yield to the temptation of continuing the flight shift just with the purpose of filling squares, using fictitious inputs to make the situation seem more complex than it is. We cannot forget that when such a deal is made with the conscience, not only is the real level of aerial skills reduced, but also considerable harm is done to morale. What now seems outwardly as a successful effort will certainly slap you in the face later on.

Ground service chiefs are also responsible for making correct decisions. As an example Captain of Technical Service Yu. Smirnov, the technical maintenance chief of one of the regiment's detachments, enjoys considerable authority. He releases an aircraft for flying only after carefully fulfilling the requirements of the unified regulations and after making sure that the pilots and navigators have performed all of their preflight operations. Having considerable experience in operating the aviation equipment, he competently transmits it to young specialists.



However, sometimes we find that certain officers do not absorb the experience of senior comrades conscientiously enough, and that they sometimes display inertia. Such an attitude toward official duties leads to unpleasantness. Thus aircraft technician Senior Lieutenant of Technical Service M. Kurovskiy once installed bad valves into the brake hydraulic system of one of the main landing gear systems due to poor technical knowledge. As a result two tires were damaged during landing. It was only owing to the outstanding skills of the craft commander, Captain V. Kiselev, that the flight ended safely.

At the opposite pole from Kurovskiy, senior aircraft technician Lieutenant of Technical Service I. Leont'yev performs his military duties honorably. The officer is said to be the best aircraft senior technician in the regiment, and the parking pad assigned to him has earned a perpetual trophy.

According to the combat training plan, a tactical flying exercise was to be conducted soon. Recognizing their personal responsibility for preparing for the exercise, every airman tried to do the best he could in each of his assignments. And soon came the long-awaited day. The orders were issued. The crews were to surmount strong "enemy" air defenses in tight combat formations and then strike an enemy airfield on the move. The airplanes were then to land at an unfamiliar airfield.

A readiness inspection showed that the crews had deeply analyzed their mission. But how would the young crew members perform?

At the appointed time a message arrived at the regiment's command post. All crews, including the young ones, had completed their assignment successfully. The overall score was high.

The results of the tactical flying exercise confirmed that combat training and political indoctrination were properly organized. But this is only one side of the matter. The other, no less important, is represented by the ability of commanders and chiefs to make correct decisions in any situation, and to implement them unfailingly. It is in the combination of these factors that we observe the main condition for further improvement of the aerial skills and combat readiness of the crews and squadrons.

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## HISTORY OF COMMAND AND CONTROL COMPLEX REVIEWED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 10, Oct 82 (signed to press 2 Sep 82) pp 44-45

[Article by Candidate of Technical Sciences G. Tamkovich, USSR State Prize laureate: "The Command and Control Complex Yesterday and Today"]

[Text] Twenty-five years is an extremely short period of history, and it is all the more so in a new pursuit. But within this short span our generation became witness to accomplishments that had seemed practically unattainable just recently, a bold and distant dream.

On 4 October 1957, the day from which we began our reckoning of the space age, another concept, another structural organism mandatory to work with artificial earth satellites was born--the command and control complex.

Regular reports on the work of command control complexes have become commonplace today. Prior to the 1950s, however, even many specialists were unsure of its structure, composition and principles of operation. But this did not disturb the pioneers of cosmonautics. The contrary is closer to the fact: The new pursuit was inspiring, and it elicited unusual enthusiasm.

The plan for the command and control complex foresaw its deployment in minimum time.

Experience that could be used in work with the complex of the future was acquired during rocket tests. But this experience was far from enough. A number of unique features now had to be accounted for: the practically unlimited range of spacecraft, the extreme accuracy with which their motion parameters have to be measured and the need for efficient mathematical processing of the measurement results. There were also unique features in the historical aspect. While creation of the first models of space rockets and spacecraft was preceded by the brilliant work of K. E. Tsiolkovskiy, Yu. V. Kondratyuk and F. A. Tsander, who laid the foundation of space flight theory, it was not until the mid-1950s that a group of Soviet scientists developed the fundamental principles of the structure and composition of the command and control complex.

Today it is difficult to imagine that in just half a year stations to track the flight of the first artificial earth satellite were deployed over the

territory of the entire Soviet Union, in the most diverse climatic and natural conditions, sometimes far away from population centers, in uninhabited regions. The time factor was paramount then. This is why the radio resources that were already available in mobile modifications were employed; the station apparatus was usually deployed on trucks or truck trailers. The personnel trained themselves to work with the radio resources in the course of installing the equipment and making independent and integrated tests. They, the first representatives of the command and control complex, had the job of blazing the trail into the unexplored frontier.

Veterans proudly recall those days long ago, and of course primarily the difficult situations. Thus a torrential spring rain in the vicinity of one of the stations flooded the single-story building. Travel was possible only by boat. The special apparatus was moved up to the roof, and the work was continued. And in the hard winter of 1959 the water intake of the cooling system servicing a diesel power plant at one of the stations suddenly blocked up just before a communication session. In the intense cold an operator dove into the reservoir and corrected the problem. The work with the satellite then proceeded uneventfully. And there were many such cases.

The missions of the command and control complex associated with the launching of the first satellites may seem rather simple to young specialists today. And in fact, they boiled down basically to making trajectory and telemetric measurements--that is, tracking a target. The complex had to monitor the movements of the artificial earth satellite and "ascertain its health" without actively influencing its flight. Moreover the onboard systems were monitored in a direct transmission mode, and the volume of information was extremely limited. But this was only the beginning of the road, and of course the satellites themselves were much simpler in those days.

In the second phase new resources were introduced into the command and control complex--combined command-and-control and command and trajectory programming systems for space objects in near-earth orbit and in outer space. While prior to this the main mission was to evaluate the state of the satellites and the correctness of design concepts, and to record and accumulate creative experience, now that the processes of controlling spacecraft flight were sufficiently well assimilated the main task was to "teach the craft to fly." To fly in orbit with the purpose of doing work useful to man and completing applied and scientific tasks.

Operation of individual spacecraft and subsequently spacecraft systems began in this phase. Now the command and control complex had to support not only test flights of models of space equipment but also its operation in orbital flight.

But no matter what the missions were, controlling the movement of spacecraft and monitoring the functions of their onboard apparatus remained an invariable and necessary mission.

Today as a rule we control spacecraft by a combined command-program method of control in which a certain share of the control functions is performed by onboard automatic systems while the other is performed by ground control

stations. The control points are located in such a way as to insure the longest possible communication with all spacecraft, no matter what their purpose. This is especially important when controlling satellites fly a low orbit (several hundred kilometers above the earth's surface). The fact is that because of the great velocity of these satellites relative to our planet, the time they remain within the zone of a tracking station's radio visibility is just a few minutes. But it would be desirable to prolong contact for information exchange as much as possible. This is why the work started by one station must be continued by another, like passing a baton in a relay race. But even from the territory of our vast country, only a fifth of an orbit is visible. To increase the time of communication, floating control stations have been set up on the World Ocean. They include the world-famous ships "Kosmonavt Yuriy Gagarin," "Akademik Sergey Korolev" and others. Airplanes may be used on occasion for short-term operation in segments of the orbit that are not visible to permanent and floating stations.

It would be pertinent to note that the concept "command and control point" is a traditional carryover from the time when the space age first began. At that time it was in fact a point that included, as a rule, a mobile station and the resources supporting its work. Today this "point" is actually an entire complex of the necessary services enjoying the possibility of independent operation. It is a complex of diverse, intricate, polyfunctional radio resources and electronic apparatus characterized by a high degree of automation and exceptional measurement accuracy. The range of this equipment varies from several thousand kilometers to several hundred million kilometers. So grew and matured the command and control complex.

The modern command and control complex is a unified, widely branched, universal network intended for the tracking, surveillance and control of all spacecraft launched in the USSR on the basis of its national program and in the interests of international cooperation.

The command and control complex contains several flight control centers outfitted with a high-power information and computer complex furnished with the latest computer technology capable of a total productivity of up to tens of millions of operations per second, communication resources, television, information display and documentation systems, remote command transmitting systems and systems providing long-distance communication with the crews. Some centers may contain a complex of simulating resources represented by mathematical and physical models of the craft. The control center interacts with the launch center and with organizations participating in control and in acquisition of information from space. The centers and points of a command and control complex maintain communication by wire, radio relay, satellite and other communication channels. The coordination-computing center and the flight control centers are the main organs of the command and control complex. They coordinate the work of all services and resources throughout the entire time of flight of a spacecraft, and they provide the necessary coordination with the launch center and organizations interested in acquiring information. Moreover they are capable of evaluating the situation and adjusting the space flight program as necessary.



The command and control complex includes command-programming, trajectory, telemetric and television systems, single time systems, crew radio communication systems, automation and computer resources, automatic information collecting and processing complexes and power supply systems. As a rule, moreover, many of them operate together, such that trajectory problems could be solved, telemetric measurements could be made, control commands could be transmitted and communication and television tasks can be completed simultaneously. These are so-called polyfunctional resources. In recent years the command and control complex has been furnished with laser trajectory measuring resources that use the energy of a reflected laser beam.

New discoveries, new worlds and new victories in the conquest of the universe have yet to be documented on the pages of the history of cosmonautics. And the command and control complex will be given its rightful place in each of them. Perhaps in the future it will be called something different, its missions will be transformed, and new measurement principles and new resources will appear, but we will never forget what the command and control complex did for us at the dawn of the space age. There are new missions, new achievements ahead.

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